Arguments/Remarks

The instant invention is a method for identifying and quantifying components in an effluent stream from an ammoxidation reactor. The method is characterized by the use of a Fourier Transform infrared (FT-IR) spectroscopy and the use of a microprocessor which is programmed to "interpret" the FT-IR spectroscopy data to identify and quantify the components. These components include reaction products and by-products, as well as unreacted feedstocks. The data obtained from monitoring these components can then be used to control the operation of the ammoxidation reactor.

Claims 10-17 remain in the application.

Claim 11 has been amended. The phrase "quantitative results" has been replaced by "quantitative data". There now is antecedent basis for the phrase "quantitative data" appearing in claim 12. Support for this amendment can be found in the Specification on page 27, line 27 – page 28, line 2.

Claims 10-17 are rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No. 3,959,341 to Dunn in view of U.S. Patent No. 6,036,840 to Christensen. Applicants respectfully traverse.

Dunn teaches the use of mass spectroscopy to analyze the reactor effluent from a reactor for the ammoxidation of propylene to acrylonitrile. Christensen teaches the use of a Fourier Transform Infrared Spectrometer to monitor the carbon dioxide evolution from an electrochemical reactor used in combining two distinct inorganic powders. These references neither alone nor in combination teach nor suggest Applicants' invention.

In simple terms Applicant's invention relates to the use a Fourier Transform infrared spectrometer coupled with the use of a microprocessor. More specifically, Applicants' invention requires the following:

(A) advancing a portion of an effluent stream from an ammoxidation reactor through a sample cell in a Fourier Transform infrared spectrometer;

(B) scanning said portion in said sample cell with infrared energy at a plurality of infrared wavelengths, wherein each of said components absorbs said infrared energy at one or more of said plurality of selected wavelengths;

(C) detecting said infrared radiation passing though said sample cell and generating absorbance data for each of the components of the effluent stream; and

(D) quantifying each of said components by comparing said absorbance data to a calibration curve for each component in a microprocessor programmed to quantify each of said components.

This combination of steps is not taught or suggested by the cited references.

Dunn does not teach the use of a Fourier Transform infrared spectrometer. Instead, Dunn teaches the use of a mass spectrometer. Mass spectroscopy is an analytic technique which is able to differentiate and identify different compounds based upon a mass-to-charge ratio of ions. It is most generally used to find the composition of a physical sample by generating and measuring a mass spectrum representing the masses of sample components. A mass spectrometers works by the following steps:

(1) Producing ions from the sample,

(2) Separating ions of differing masses,

(3) Detecting the number of ions of each mass produced, and

(4) Collecting the data and generating the mass spectrum.

In contrast, infrared spectroscopy deals with the infrared region of the electromagnetic spectrum. Infrared spectroscopy exploits the fact that molecules have specific frequencies at which they rotate or vibrate corresponding to discrete energy levels. These resonant frequencies are determined by the shape of the molecular potential

energy surfaces, the masses of the atoms, and by the associated vibronic coupling. An infrared spectra of a sample is collected by passing a beam of infrared light through the sample. Examination of the transmitted light reveals how much energy was absorbed at each wavelength. This can be done with a monochromatic beam which changes in wavelength over time or by using a Fourier transform instrument to measure all wavelengths at once. From this, a transmittance or absorbance spectrum can be produced, showing at which IR wavelengths the sample absorbs. Analysis of these absorption characteristics reveals details about the molecular structure of the sample.

As discussed above, mass spectroscopy and infrared spectroscopy work on very different principles. Mass spectroscopy is based on the mass-to-charge ratio of ions. Infrared spectroscopy is based upon energy absorption of infrared light over multiple wavelengths. The requirements set forth in items (A), (B), (C) and (D) of applicants' claimed invention cannot be provided by mass spectroscopy nor are the features of items (A), (B), (C) and (D) taught or suggested by Dunn.

Further, there is no teaching or suggestion in either of the cited references that infrared spectroscopy is a substitute for mass spectroscopy. More specifically, there is no teaching or suggestion in either Dunn or Christensen that infrared spectroscopy is analogous to or is a substitute for mass spectroscopy.

Applicants' invention further requires the use of a microprocessor to determine the quantity of each component in the reactor effluent by comparing absorbance data to a calibration curve for each component [item (D) of claim 10]. This step is not taught or suggested by Dunn or Christensen, either alone or in combination. Instead, Dunn teaches the use of a computer *only* for the conveyance of data to the Process Control Room. (See column 13, lines 61 to column 14, line 3). Dunn does not teach the use of a microprocessor as being integral to the identification or quantification of the components in the effluent. Further, Christensen only teaches that a Fourier Transform infrared spectrometer is used to analyze carbon dioxide in the exhaust gas of an electrochemical

reactor. This can be done without the use of a microprocessor. Christensen makes no mention of a microprocessor being used to assist in the analysis of the exhaust gas.

Lastly, with respect to Christensen, this patent relates to electrochemical reactors. Its teachings and claims are directed to current flow, electrodes, counter electrodes, electrolytic solutions etc. This patent has nothing to do with ammoxidation reactions or reactors for the production of acrylonitrile. Christensen is non-analogous art with respect to ammoxidation reactors to which this invention relates. At best, Christensen is proof that Fourier Transform infrared spectrometry was known and in use at the time the Christensen application was filed in 1998. Applicants do not dispute this.

Summary

In summary, the features of Applicants' invention are neither taught or suggested by the cited references alone or in combination. Applicants respectfully request the Examiner to withdraw the outstanding rejection and to forward the application to issuance.

Respectfully submitted,

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